

# JACARA's Plans

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## Abstract

The plans of JACARA, the Joint Australian Centre for Astrophysical Research in Antarctica, for Australian involvement in future astronomical activities on the antarctic plateau, are outlined.

**Keywords:** Instrumentation: Miscellaneous, Telescopes

## 1 Introduction

JACARA is the “Joint Australian Centre for Astrophysical Research in Antarctica”. It has been created by a memorandum of understanding between the University of New South Wales (UNSW) and the Australian National University (ANU), with the aim of coordinating Australian efforts in antarctic astronomy. It aims to model its activities on those of the US CARA, the “Center for Astrophysical Research in Antarctica”, a consortium of US universities and institutions funded by the NSF and operated from Yerkes Observatory of the University of Chicago. JACARA is run, under the direction of a scientific steering committee, from twin nodes at the UNSW and ANU, and receives advice from the Australian Working Group for Antarctic Astronomy. This paper discusses JACARA’s plans for the development of astronomy on the antarctic plateau.

## 2 South Pole Activities

JACARA currently participates in the site testing programme underway at the South Pole as part of the CARA’s “Advanced Telescope Project” (ATP), coordinated by Dr. John Bally of the University of Colorado. JACARA’s primary directive is to continue its participation in CARA’s activities to the mutual benefit of both partners. Currently we have two experiments underway with CARA at the Amundsen-Scott South Pole Station, initiated by the UNSW group. These are a near-IR sky monitor (the ‘IRPS’, originally from the Anglo Australian Telescope), being used to quantify the reduction in sky background at the Pole, and a microthermal turbulence sensor, being used to measure the level and location of the atmospheric turbulence that produces astronomical “seeing”. This latter experiment is in collaboration with the Université de Nice, and was designed by Dr. Jean Vernin.

JACARA is planning to expand its site testing programme. Design work is underway at UNSW for instruments to measure the UV/visible sky brightness and both the near-IR and mid-IR sky brightness, and by the ANU for a differential image-motion monitor (DIMM). The Australia Telescope National Facility (ATNF) plans to contribute to the measurement of phase stability at mm-wavelengths.

### 3 Site Testing on the high plateau

JACARA believes the best sites for astronomy will likely lie at the highest points of the antarctic plateau: Domes Argus and Circe. Site testing at these remote sites is essential prior to development of a new scientific station to operate an observatory. To this end JACARA has sought, and received, funding from the UNSW and ANU to purchase a Lockheed Martin “Automated Geophysical Observatory”, a mobile laboratory that can be transported to a remote site and operate, autonomously, a set of experiments. With CARA, we are now designing the suite of low-powered site testing instruments to be placed in the renamed “Automated Astrophysical Site Testing Observatory” (AASTO). With the assistance of the NSF, we then plan to deploy the AASTO, using a ski-equipped LC130 aircraft, to the South Pole at the end of 1997, to Dome C at the end of 1998, and to Dome A at the end of 1999. Our goal is to determine the site for an international antarctic observatory by the year 2000.

The plan to station an AASTO at Dome C may conveniently coincide with the French-Italian plans to construct a new station, Concordia, at that location. If this happens, JACARA has proposed to the Dome Concordia project a comprehensive suite of site testing experiments that could be undertaken using both the manned and automated facilities.

### 4 Astronomical Projects

While the current focus of JACARA’s activities is on site testing, naturally we have been considering the kinds of telescope projects that we might get involved in. Such plans are, of course, embryonic while site testing operations are underway, and may change as their results come in. JACARA believes the key to Australian involvement in a major antarctic observatory is through international collaboration.

In the intermediate term there are two likely projects of interest, a 2.5m-class near-IR telescope, which we have dubbed the “Federation Telescope” in light of the impending centenary of Australian federation in 2001, and an 8m-class sub-mm telescope. Such ideas parallel those of CARA, which is contemplating a 2m-class near-IR telescope and an 10m-class sub-mm / mid-IR telescope (LASIRT—the Large Antarctic Sub-mm IR Telescope). Such projects could be undertaken within the next 5 years. Their scale is sufficiently small that the engineering problems associated with their con-

struction are well understood, but large enough that significant new science could be achieved.

In the long term JACARA believes the astronomical community will wish to construct its largest telescopes on the best site on Earth, and thus be aiming to construct major facilities on the antarctic plateau. It is too early to do more than speculate what these facilities may be, but there are several exciting possibilities. One in particular that JACARA has been studying is that of deploying an aerostat (a large, tethered balloon) in the stratosphere, with interchangeable platforms to deploy optical / near-IR and far-IR / sub-mm telescopes. This would provide diffraction limited viewing in the optical and near-IR wavebands, with a virtually transparent atmosphere across the far-IR and sub-mm. In other words, achieving space-based performance from an Earth-based facility. Other grand-challenge projects of interest include the construction large mm interferometers, and even sub-mm interferometers if the site proves viable for such a facility.

## **5 The Political Scene**

JACARA is now providing the focus for Australian efforts in antarctic astronomy and thus is establishing linkages with the appropriate bodies to harness both funding and international collaborators. JACARA liaises with the Australian Antarctic Division, but has no direct link as our activities fall outside the scope of the science the Antarctic Division can currently support. JACARA is actively promoting international cooperation through partnerships we are fostering in the International Astronomical Union (IAU) and the Scientific Committee for Antarctic Research (SCAR), the international scientific unions for astronomy and Antarctica. We are also developing links with other scientific bodies interested in working from the high plateau, such as the geophysical community.

## **6 Australian Astronomy Beyond 2000**

JACARA is not a Commonwealth funded body, and our plans should be placed in context with those of the Australian astronomy community. The report of the Review Committee of the National Committee for Astronomy of the Australian Academy of Science, “Australian Astronomy Beyond 2000” does this.

According to that report, the top priority of the Australian astronomy community is to accept the invitation to join the European Southern Observatory. Regarding future facilities, the review ranked two leading projects equally. One was to play a significant role in the construction of a 1-km aperture cm-wave radio telescope. The other was to play a significant role in an international observatory on the antarctic plateau.

The review placed one pre-requisite on this venture, the successful outcome of a site testing programme. If this is successful, the astronomy community could expect to spend  $\sim 20\%$  of the capital funding that it receives over the next decade on this project. There is no capital development budget within Australian astronomy, but historically the spending amounts to approximately \$100 million per decade. The review expects that Australian interests will principally lie in the optical / IR / sub-mm / mm wavebands, and expects that we will be involved in a collaborative international approach.

JACARA's activities conform to the review's expectations. The current site testing programme, for which funding is being obtained through recurrent budgets, is seeking quantitative answers to the questions on site performance, and will be complete by 1999. Our international activities are designed so that we will then be in a position to contribute significantly to the construction of an international observatory by the year 2000.